NWS FORM E-5 U. S. DEPARTMENT OF COMMERCE |HSA OFFICE: RNK
NOAA, NATIONAL WEATHER SERVICE BLACKSBURG, VA

MONTHLY REPORT OF RIVER/FLOOD CONDITIONS

TO: NATIONAL WEATHER SERVICE
HYDROMETEOROLOGICAL INFO CENTER
1325 EAST-WEST HIGHWAY
SILVER SPRING, MD 20910

|REPORT FOR:
| March 2010

| Date: 4/8/10

|Signature: Peter Corrigan

Summary: Hydrologic activity across the Blacksburg Hydrologic Service Area (HSA) in March was marked by two significant events; the first was a major flash flood event on March 12-13 and the second was flash flooding and river flooding in the Dan River basin March 29-31. Mean March precipitation was 4.40 inches versus the long-term average (1971-2000 normal) for this month of 4.14 inches (73 of the 75 cooperative stations reporting), or 106 percent of average. Precipitation at NWS stations ranged from a low of 2.43" at Saltville (SLTV2) in Smyth County, VA to a high of 8.90" at Keysville (KEYV2) in Charlotte County, VA. Monthly average temperatures ranged from near normal at Bluefield, WV at 44.5°F (-0.5°) to above normal at 43.5°F in Blacksburg (+2.1°) and 51.4°F at Danville (+3.5°).

The early part of March was relatively uneventful, with one last snow event March 2-3 which dropped several inches of snow in the mountains and less than an inch in the eastern piedmont. Liquid equivalents ranged from over 0.25 inches in the southeast to less than 0.10 inches in the western mountains. Temperatures warmed considerably during the second week in March, finally climbing above 60F at the Blacksburg NWS office for the first time since November 30th, a 99-day stretch which was the longest sub-60 degree period since records began in 1952. This also marked the elimination of snow cover at the NWS office after 73 days this winter with 1 inch or more on the ground, which may have been a record as well (records are not 100% complete). Total winter snowfall at the Blacksburg NWS office was 53.6 inches which was the 3rd snowiest on record and Bluefield had its snowiest winter on record at 81.1 inches.

Even in the wake of the early March warm-up substantial snow cover persisted in the higher elevations, west and north slopes and extensive wooded areas of southeastern West Virginia well into the upper Greenbrier River basin in Pocahontas County. Snow water equivalents in parts of this basin were still as high as 5 inches in some locations as late as the 10th. The continued presence of this snow combined with the warmer temperatures and forecasts of an approaching area of low pressure, prompted a Flood Watch to be issued for the Greenbrier River late on the 9th. Ensemble river forecasts using both GFS and SREF precipitation inputs gave strong indications for several days that moderate to major flooding was possible on the Greenbrier River and minor flooding on the James River. The complex storm expected to induce this flooding developed from March 11-13, as an upper level low over the north central U.S. dropped slowly southeastward, and several areas of low pressure formed. The primary low over the Ohio Valley weakened and an occluded front over

eastern Kentucky pushed into the area late on the 12th with secondary redevelopment occurring along the North Carolina coast. Moderate to heavy rains began over the western HSA during the evening hours of the 12th with hourly rates of 0.25" to 0.50" at several IFLOWS gages in the far western counties, increasing to near 1" per hour at several gages. Very high runoff occurred due to the wet soils from recent snowmelt and from actual snowmelt in some areas, combining to produce severe flash flooding and river flooding mainly in the New and Greenbrier river basins. Counties most affected included Mercer and Greenbrier in West Virginia and Giles and Pulaski in Virginia. Figure 1 below shows storm total rainfall amounts, most of which fell in roughly 12 hours during the evening and early morning hours of March 12-13. The 4 to 5-inch amounts estimated by radar in southeastern Bland and far northwest Pulaski counties were unconfirmed by rain gage measurements. Table 1 also below shows rain gage totals which ranged from 2 to 3.5 inches in the most affected areas.

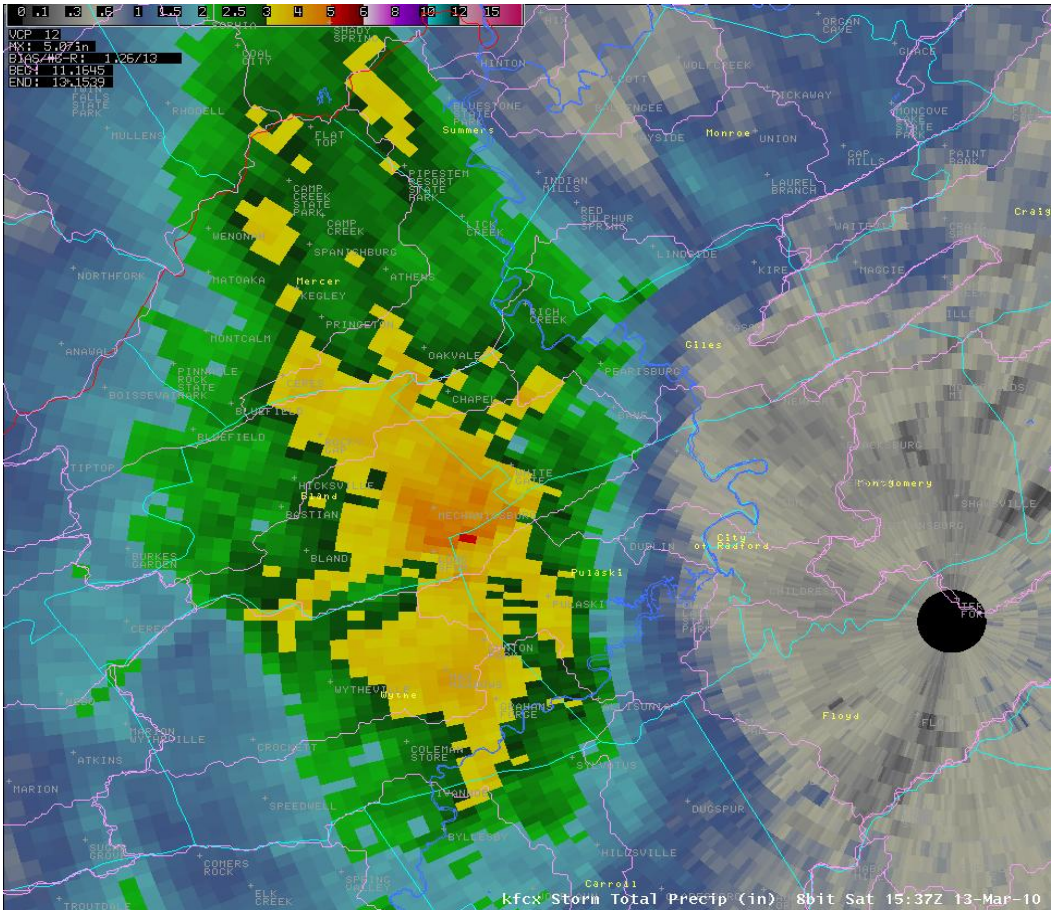

Figure 1. KFCX WSR-88D Storm Total rainfall – March 11-13, 2010

Table 1 – Top fifteen 24-hour Precipitation amounts: RNK HSA – valid 12Z, March 13, 2010

SHEF ID	Station	County	Type	Precipitation
ERDW2	ELLISON RIDGE	SUMMERS	IFLOWS	3.62
PIRW2	PIPESTEM	SUMMERS	RAWS	3.23
PIPW2	BLUESTONE R. AT PIPESTEM	SUMMERS	DCP	3.20
PCRV2	PEAK CREEK	PULASKI	IFLOWS	2.96
EGRW2	EGERIA	MERCER	IFLOWS	2.95
GLWW2	GLENWOOD	MERCER	IFLOWS	2.92
SLAV2	SLATE MTN.	PATRICK	IFLOWS	2.88
COPV2	COPPER HILL	FLOYD	IFLOWS	2.68
WITV2	WITT'S ORCHARD	ROANOKE	IFLOWS	2.64
SLOV2	SLOAN BRANCH	BOTETOURT	IFLOWS	2.60
DISV2	DISMAL	GILES	IFLOWS	2.60
EAMW2	EADS MILL	MERCER	IFLOWS	2.49
MODV2	MEADOWS OF DAN	PATRICK	COOP	2.43
SFRV2	STONY FORK	WYTHE	RAWS	2.34
PSKV2	PULASKI	PULASKI	COOP	2.24

The heaviest rains fell between about 02z to 06Z with rates that were fairly intense for mid-March, running from 0.2 to 0.5 inches per hour at the height of the storm. Several more intense storm elements produced higher rates including 1.10" in 1 hour from 03Z to 04Z at Stony Fork RAWS and 1.03" at Ellison Ridge IFLOWS about the same time. A Flash Flood Warning was first issued at 9:36 PM (0236Z) for portions of Bland, Giles, Mercer, Monroe and Summers counties. Additional Flash Flood Warnings were issued and xtended in time and areal coverage through the early morning hours and later became Areal Flood Warnings as the 'flash' portion of the event came to an end. Numerous flood reports were received from spotters and law enforcement agencies through the early morning hours.

Among the larger and gaged river and streams, the hydrologic response was most pronounced along the Bluestone River, East River and Brush Creek in Mercer County, WV and along Walker Creek and Wolf Creek in Giles County, VA. Figure 1 below shows the record (1951-2009 data) flood hydrograph for the Bluestone River at Pipestem (PIPW2), which crested in about 9 hours from the start of the heavier rainfall, with discharge increasing from around 3,500 cfs to over 22,500 cfs over that time period. According to USGS weighted estimates (Wiley, et al., 2000) this peak discharge is very close to the .01 annual chance of occurrence ('100-year' flood recurrence interval). The Pipestem stream gage is located just above where the Bluestone River empties into Bluestone Lake and the incredible flow on this river combined with high flows on the Greenbrier River combined to drive the pool elevation at Bluestone Lake up over 37 feet in the next 48 hours from around 1409 to over 1447 feet pool elevation (mean sea level).

On Walker Creek at Bane (BANV2) in Giles County, VA the USGS stream gage crested at 17.92 feet (20,900 cfs), which is the 2nd highest on record since 1939 and 3rd overall (the peak stage/discharge from 1878 was estimated). Wolf Creek (WOLV2), also in Giles County had its 3rd highest measured stage/discharge as well at 13.37 feet (15,200 cfs). Recurrence intervals for the

discharge at both these gaging stations was close to or exceeded the .01 annual chance, possibly .005 chance at Wolf Creek , depending on the statistical methodology used (Bisese, 1995).

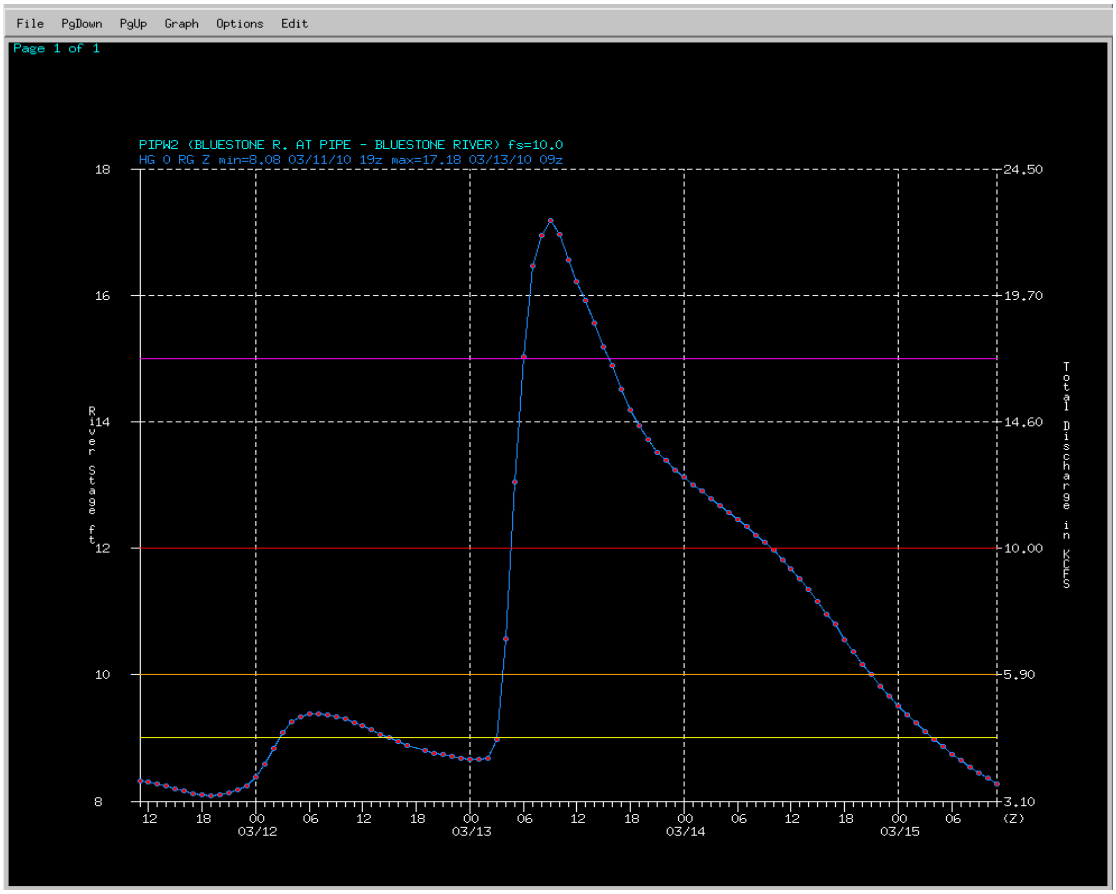

Figure 2. Stage/Flow Hydrograph, March 12-15, 2010 – Bluestone River at Pipestem (PIPW2)

The flooding caused significant damage to roads and bridges along with home and property damage. The flooding along Wolf Creek in Giles County was significant in several locations including several homes in the town of Narrows and Route 42 was closed in several locations. Walker Creek and other small streams also flooded several homes and closed roads across Giles County. Peak Creek in northwest Pulaski County flooded portions of the downtown area and threatened the 911 center with water. Giles County, VA had damages to at least 20 roads according to Virginia Department of Transportation and Emergency Management reported up to 93 homes in the county affected by flood waters. Two homes were destroyed and 31 received major damage. According to County Emergency Management, damage estimates from Giles County alone approached $2 million while Pulaski County had "only" $65 thousand in damages.

In Mercer County there were evacuations along the East River near Oakvale and along the Bluestone River near Spanishburg. Greenbrier County had very serious flooding primarily from snowmelt in the Rainelle area. FEMA survey teams were dispatched in southeast West Virginia to both Greenbrier and Mercer counties shortly after the event. In Greenbrier County at least 270 homes were affected by flooding and Mercer County reported some damage to about 100 homes

and 60 roads or bridges. Preliminary damage estimates from the West Virginia Department of Highways for state-maintained roads and bridges in Mercer County amounted to approximately $3.6 million, while private property damage approached $1 million.

In a small irony, the Greenbrier River at Alderson (ALDW2), forecast to see flooding for nearly five days beforehand, ended up cresting below flood stage due to less rainfall and snowmelt in the upper basin than was expected. Minor river flooding was observed on the lower Roanoke River at Randolph (RNDV2) and James River at Bremo Bluff (BREV2) on March 14-15, but impacts were slight.

In summary, this was one of the most high-impact flash flood events to affect at least a part of the RNK HSA in the past 5 years with preliminary damages of at least $6 million. Most fortunately no direct injuries or fatalities were reported in the RNK area as a result of the flooding. On the scale of Flash Flood events first developed by Davis (Davis, 2002) and adapted by Jackson and Stonefield (2008) for the RNK HSA, the event would be classified as FS4 or FS5, Severe or Catastrophic. Such events accounted for only 6% all flash flood events from 1994-2007.

A warm and tranquil weather regime ensued until late in the month when low pressure tracked into the Ohio Valley on the 28th, as the upper-level pattern sharpened ahead of an approaching cold front. Strong thunderstorms developed over the Carolina piedmont in advance of the approaching area of low pressure with more general rainfall back over the mountains. By evening training thunderstorms, some of them severe with tornadic signatures, tracked from central North Carolina across the southeastern portions of the Dan River basin. A fairly narrow axis of very heavy rain, from 2 to 4 inches, fell along the tracks of these storms in parts of Rockingham, Caswell, Pittsylvania, Halifax and Charlotte counties during the evening hours of the 28th (see Fig. 3 below). Highest rain gage totals for the 24 hours ending at 12Z on March 29th included: Keysville COOP (KEYV2) 4.70", Reidsville COOP (RDVN7) 4.54", Danville COOP (DNVV2) 3.91", Danville ASOS (DAN) 3.76" and South Boston COOP (SOBV2) 2.80". The 24-hour rainfall ending at midnight set a date record at Danville ASOS with 3.53", breaking the old record of 1.37" set in 1994. The intense rains prompted several Flash Flood Warnings in the area of heaviest rainfall, with several reports received of small stream flooding and water over roads in Rockingham and Pittsylvania counties.

River flood warnings were also issued for the Dan River as the heavy rainfall in the lower basin caused an extremely rapid rise on the Dan. The Danville river gage rose about 8 feet in 6 hours but crested just short of flood stage, while the Dan at Paces (PCEV2) and South Boston (SBNV2) reached flood stage later on the 29th (see E-3 section below). In addition the lower Roanoke River at Randolph (RNDV2) crested above flood stage.

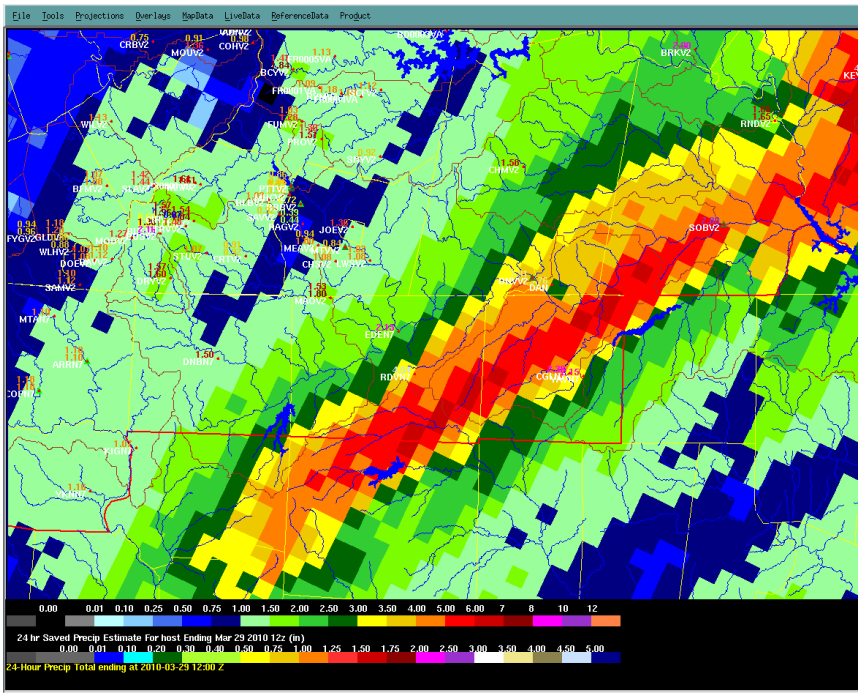

Figure 3. 24-hour MPE rainfall ending 12Z March 29, 2010 across far southeastern counties (Rockingham, Caswell, Pittsylvania, Halifax)

Non-Routine Hydrologic Product Summary (Mar):
Flood/Flash Flood Watches (FFARNK): 2
Flood Advisories (Urban/Small Stream - FLSRNK): 0
Flash Flood Warnings (FFWRNK): 10
Areal Flood Warnings (FLWRNK): 16
River Flood Warnings (FLWRNK - forecast points): 12

References:

1. Wiley, J.B., Atkins, J.T., and Tasker, G.D., 2000: Estimating Magnitude and Frequency of Peak Discharges for Rural, Unregulated Streams in West Virginia: USGS Water Resources Investigation Report 00-4080, 93 p.

2. Bisese, J.A., 1995: Methods for Estimating the Magnitude and Frequency of Peak Discharges of Rural, Unregulated Streams in Virginia: USGS Water-Resources Investigations Report 94-4148, 70p.

3. Jackson J. and Stonefield, R. 2008: An Abbreviated Flash Flood/Flood Climatology (1994-2007) for the WFO Blacksburg, Virginia County Warning Area. NOAA Technical Memorandum NWS ER-104 (available on line: http://www.werh.noaa.gov/SSD/erps/tm/tm104.pdf)

4. Davis, R. S., 2002: The flash flood (FF) index: estimating flash flood severity. *Proceedings of the Symposium on Managing the Extremes, Floods and Droughts*, Roanoke, VA, Environmental and Water Resources Institute of ASCE, CD-ROM.

NWS FORM E-3

U.S. DEPARTMENT OF COMMERCE
NOAA, NATIONAL WEATHER SERVICE

FLOOD STAGE REPORT

HYDROLOGIC SERVICE AREA: **Blacksburg, VA (RNK)**

MONTH: **March** YEAR: **2010**

RIVER AND STATION	FLOOD STAGE (FEET)	ABOVE FLOOD STAGE		CREST		
		FROM	TO	STAGE (FEET)	DATE	TIME (UTC)
Dan River						
Paces (PCEV2)	20	3/29/10	3/31/10	22.09	3/29/10	2030
South Boston (SBNV2)	19	3/29/10	3/31/10	24.95	3/30/10	0310
Roanoke River						
Randolph (RNDV2)	21	3/14/10 3/29/10	3/15/10 3/30/10	22.76 21.20	3/15/10 3/29/10	0130 2245
James River						
Bremo Bluff (BREV2)	19	3/15/10	3/15/10	19.40	3/15/10	0400

cc:
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